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Association between health-related quality of life and impaired glucose metabolism in Iran: the Qazvin Metabolic Diseases Study

A. Ghorbani, A. Ziaee, N. Esmailzadehha and H. Javadi

Metabolic Diseases Research Center, Qazvin University of Medical Sciences, Qazvin, Iran

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Abstract

Aim To evaluate the association between health-related quality of life and glucose metabolism status in a study population in Qazvin, Iran.

Methods This cross-sectional study was conducted in 1044 people (aged 20–78 years old) between September 2010 and April 2011 in Qazvin, Iran. An oral glucose tolerance test was performed for each participant who had never been diagnosed with diabetes. Participants were characterized as having normal glucose metabolism, pre-diabetes or diabetes according to American Diabetes Association criteria. The short-form 36 questionnaire was used to measure quality of life. Data were analysed using a chi-squared test, ANOVA and ANCOVA.

Results A total of 530 (51.7%) of the participants were women, and 24.1 and 11.6% of the participants were categorized as having prediabetes and diabetes mellitus, respectively. Except for the role emotional domain, there was a gradual decrease in the mean scores of every domain of the short-form 36 scale across the three study groups. The mean scores in the physical domains were significantly different among the participants with normal glucose metabolism and those with diabetes. After adding age as covariate, there were no significant differences between the categories in any of the domains.

Conclusion There is no association between quality of life domains and glucose metabolism status in Iranian subjects. More longitudinal studies are necessary to investigate the natural history of pre-diabetes, diabetes and quality of life.

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Introduction

Health-related quality of life is an important factor in chronic diseases where a cure is unlikely. Chronic disease may result in greater concern about function and well-being than the physiological measures that healthcare providers consider useful [1].

The prevalence of diabetes mellitus has increased so rapidly worldwide that it has reached epidemic proportions. [2] It is a major cause of morbidity and mortality, and has been associated with a poor quality of life [3]. Pre-diabetes is a state of abnormal glucose homeostasis which presents as impaired fasting glucose, impaired glucose tolerance, or both [4]. Diabetologists agree that pre-diabetes should be termed a disease [5]. Impaired glucose metabolism causes macrovascular diseases and Type 2 diabetes, which contributes to microvascular disease [5].

Although diabetes has an obvious impact on health-related quality of life, the association between pre-diabetes and change in well-being and health-related quality of life needs further evaluation [6]. It is unclear whether quality of life is diminished at or before the onset of diabetes, among those with pre-diabetes [3]. This stimulated our interest in examining the association between health-related quality of life and glucose metabolism status in Qazvin, Iran.

Subjects and methods

This cross-sectional study was conducted in 1107 people between September 2010 and April 2011 in Qazvin, which is located 150 km northwest of Tehran, Iran. The research project was approved by the medical research ethics committee of Qazvin University of Medical Sciences.

Correspondence to: Neda Esmailzadehha. E-mail: nesmailzadehha@qums.ac.ir

What's new?

- This study is one of the few studies that investigate the association between glucose metabolism status and quality of life in a population-based design using an oral glucose tolerance test.
- It is unclear whether quality of life is diminished at or before the onset of diabetes, among those with pre-diabetes. In the present study we examine health-related quality of life among people with diabetes, people with pre-diabetes and people with normal glucose metabolism.

The study participants were selected by multistage cluster random sampling methods from residents of the Mindoodar district of Qazvin. Potential participants were invited by telephone to attend the study at the health centre and, after explanation of the study details, they were free to participate. All participants gave their written informed consent. Demographic and social data were self-reported in the questionnaire given to the participants. Details of the sampling method and data collection have been reported elsewhere [7].

A venous blood sample from each participant was taken after a 12–4-h overnight fast. All the samples were analysed at the same laboratory on the day of blood collection. Blood glucose level was measured in all participants. An oral glucose tolerance test was performed for all the participants who had never been diagnosed with diabetes.

Impaired fasting glucose was defined as fasting plasma glucose levels ≥5.6 mmol/L but <7.0 mmol/L. Impaired glucose tolerance was defined as 2-h values in the oral glucose tolerance test ≥7.8 mmol/L but <11.1 mmol/L. Impaired fasting glucose and impaired glucose tolerance were considered to indicate pre-diabetes. Diabetes was defined as fasting plasma glucose ≥7.0 mmol/L or 2-h post-load glucose ≥11.1 mmol/L during an oral glucose tolerance test, or previous diagnosis of diabetes [8]. According to glucose metabolism status, the study population was divided in three groups: participants with normal glucose metabolism, those with pre-diabetes and those with diabetes.

To assess participants' health-related quality of life, we used the short-form health survey 36 questionnaire (SF-36). Data from the SF-36 questionnaire were self-reported. This questionnaire includes 36 questions that measure eight separate domains: physical functioning; role physical; bodily pain; general health; vitality; social functioning; role emotional and mental health. Each domain is scored from 0 to 100, where higher scores correspond to a better health-related quality of life [9]. Socio-demographic characteristics of the study participants are presented as frequency and percentages, while health- related quality of life domain scores are given as mean (SD) values. Data were analysed using a chi-squared test and ANOVA. An ANCOVA test was used to adjust for the effect of age and other confounders. The adjusted health-related quality of life domain scores are reported as mean (SE) values. P values < 0.05 were considered to indicate statistical significance.

Results

A total of 529 men and 578 women aged 20–78 years [mean (SD) age 40.08 (10.33) years] enrolled in the study, and of these, 1044 had complete questionnaires and laboratory tests. Of these 1044 participants, 530 (51.7%) were women, and 24.1 and 11.6% were categorized as having pre-diabetes and diabetes mellitus according to American Diabetes Association criteria, respectively. The socio-demographic characteristics of the participants are shown in Table 1. Participants with normal glucose metabolism were younger than those in the pre-diabetes or the diabetes study groups.

The crude and adjusted mean health-related quality-of-life scores for each domain of the SF-36 scale for each of the three study groups and adjusted P values are shown in Table 2. Except for role emotional, there was a gradual decrease in the mean scores for every domain of the SF-36 scale across the three study groups. The mean scores for the physical domains were significantly different among the three groups. A *post hoc* test showed that these differences were attributable to the differences between the normal glucose metabolism and diabetes groups. The mean scores for all domains were not significantly different between participants with normal glucose metabolism and those with pre-diabetes. The only significant difference for participants with pre-diabetes compared with participants with diabetes was in the physical functioning domain ($P = 0.01$). The differences in mean scores for mental domains were not statistically significant among the study groups. After adjusting for gender using an ANCOVA test, the differences among the groups in the physical domains of the SF-36 remained significant. There were no significant differences among the study groups in any domain score when age was added as a covariate.

Discussion

Focus on health-related quality of life has increased considerably. It is accepted that people with diabetes have significantly lower health-related quality of life compared with those who do not have diabetes [10]. The prevalence of diabetes and pre-diabetes is increasing annually worldwide [5,11,12]. People with pre-diabetes are at increased risk of diabetes [2,11] and cardiovascular events [8,13]. The prevalence of obesity is increasing worldwide, which will increase the burden of pre-diabetes and diabetes [14].

The present study is one of the few studies to investigate the association between glucose metabolism status and quality of life using a population-based design and an oral

Table 1 Socio-demographic characteristics of the study participants

Study group	Total	Diabetes	Pre-diabetes	Normal glucose metabolism	*P*
Sex, *n* (%)					
Male	513	48 (9.4)	150 (29.2)	315 (61.4)	<0.001
Female	530	66 (12.5)	103 (19.4)	361 (68.1)	
Age, mean (SD)		47.04 (9.38)	43.80 (9.50)	37.68 (9.88)	<0.001
Educational level, *n* (%)					
No formal education	32	10 (31.2)	10 (31.2)	12 (37.5)	<0.001
<12 years	805	91 (11.3)	198 (24.6)	516 (64.1)	
>12 years	201	11 (5.5)	44 (21.9)	146 (72.6)	
Work status, *n* (%)					
Employed	391	25 (6.4)	91 (23.3)	275 (70.3)	<0.001
Unemployed	53	0 (0)	13 (24.5)	40 (75.5)	
Housewife	421	61 (14.5)	91 (21.6)	269 (63.9)	
Pensioner (Retired)	171	28 (16.4)	55 (32.2)	88 (51.5)	

Table 2 Short-form health survey-36 scores for health-related quality of life in the three study groups

	Crude scores, mean (SD)				Age- and gender-adjusted scores, mean (SE)			
	Normal glucose metabolism	Pre-diabetes	Diabetes	*P*	Normal glucose metabolism	Pre-diabetes	Diabetes	*P*
Domain								
Physical functioning	80.95 (20.91)	79.09 (21.17)	71.97 (25.80)	<0.001	79.85 (0.824)	80.74 (1.368)	76.32 (2.03)	NS
Role physical	72.30 (33.26)	67.29 (35.56)	62.06 (38.39)	<0.001	71.25 (1.33)	68.13 (2.21)	67.07 (3.29)	NS
Bodily pain	65.34 (20.59)	63.24 (21.37)	60.17 (25.38)	<0.001	64.94 (0.814)	62.80 (1.35)	63.18 (2.01)	NS
General health	63.59 (17.32)	61. 20 (18.52)	58.10 (18.34)	<0.001	63.33 (0.69)	61.45 (1.14)	59.41 (1.70)	NS
Vitality	62.06 (18.09)	61.02 (17.72)	60.57 (19.97)	NS	62.07 (0.705)	60.57 (1.17)	61.80 (1.74)	NS
Social functioning	75.72 (20.70)	75.14 (21.60)	70.83 (24.25)	NS	75.73 (0.83)	75.70 (1.39)	71.50 (2.07)	NS
Role emotional	66.56 (37.97)	70.48 (35.36)	62.57 (40.19)	NS	67.13 (1.47)	69.38 (2.44)	62.57 (3.64)	NS
Mental health	67.07 (17.64)	66.33 (17.73)	65.68 (19.86)	NS	66.99 (0.70)	65.78 (1.16)	66.24 (1.73)	NS

NS, nonsignificant.

glucose tolerance test. In the present study we found a gradual decrease in quality of life among three categories of glucose metabolism. This is consistent with two earlier studies by Hiltunen *et al.* [15] and Tapp *et al.* in their Australian Diabetes and Lifestyle (AusDiab) study [3], which assessed similar areas and showed a general pattern of worsening quality of life across glucose metabolism categories [3,15]. The follow-up of the AusDiab study showed that impaired fasting glucose and impaired glucose tolerance (pre-diabetes), as well as diabetes at baseline, reduce health-related quality of life [16].

In the present study, the initial analysis showed that the differences between categories were statistically significant. People with Type 2 diabetes had a lower health-related quality of life in all physical domains and their scores were significantly different from those with normal glucose metabolism; however, the observed association of glucose metabolism status with health-related quality of life was attributable to age. The increasing prevalence of diabetes with age is the most likely explanation for this observation [17]. Consistent with studies by Schunk *et al.* [18] and de Zwaan *et al.* [19], age seems to impair physical health-related quality of life substantially. In another study, Seppälä *et al.* [20] excluded patients with established cardiovascular disease and previously diagnosed diabetes, and found that the deterioration in health-related quality of life in subjects with impaired fasting glucose or impaired glucose tolerance was not significant.

The scores for the mental domains of the SF-36 showed a similar pattern of gradual decrease but the differences did not reach statistical significance. It can be concluded that poor glycaemic control is related to poorer quality of life in physical aspects [21]. In a study by Häkkinen *et al.* [22], the health-related quality of life of people at risk for Type 2 diabetes was compared with that of the Finnish general population. They showed that the health-related quality of life of those at risk was significantly lower in the general health and bodily pain domains but, conversely, mental health and role emotional dimensions were better than in the general population. In a cross-sectional study, Mena Martín *et al.* [23] showed that patients with diabetes had lower scores in the physical function, bodily pain, general health

and vitality domains but their social function and mental health were not affected.

The present study showed that the mean score for the physical functioning domain of the SF-36 in participants with pre-diabetes was significantly different from that in participants with diabetes and this association was also related to age. Symptoms of diabetes develop so gradually that many people do not recognize them; most people with pre-diabetes or diabetes are unaware of their glycaemic state [24]. People with pre-diabetes may already have some of the problems associated with diabetes. Complications resulting from diabetes, treatment, glycaemic control and psychological aspects may adversely affect many aspects of a patient's life, including their quality of life [25].

In the present study, gender did not affect the association between glucose metabolism status and physical health-related quality of life. Schunk *et al.* [18], in a study using the short-form health survey 12 questionnaire, showed that women with Type 2 diabetes had a significantly lower mental component summary. Older people in that study had a lower physical component summary, but a higher mental component summary was found for people with and without Type 2 diabetes. It must be considered that the higher the number of chronic and somatic illnesses and the higher the BMI, the more deterioration in physical health-related quality of life would be reported [19]. Nevertheless, factors that may affect women with impaired glucose metabolism should be researched more thoroughly.

The negative consequences of Type 2 diabetes on health-related quality of life highlight the burden of the disease and the importance of prevention programmes. Medical experts concur that one of the major challenges associated with diabetes is prevention [26,27]. It has been shown that the Diabetes Prevention Program can prevent or delay the development of Type 2 diabetes in people with impaired glucose tolerance [12,28]. There is strong evidence from many clinical trials indicating that lifestyle changes can prevent or delay Type 2 diabetes in the at-risk groups [29,30]. Any prevention programme needs to focus on identifying and providing access to effective behavioural and lifestyle intervention in people at high risk of diabetes [27].

Primary and secondary prevention strategies are necessary to control diabetes, which will bring positive effects on the health-related quality of life of affected people [10]. Diabetes causes debilitating, costly and deadly complications that are more common or more severe when diabetes is poorly controlled [11].

Diabetes is often noted as a disease of affluence, so health education could help in promoting the lifestyle changes that are the most influential in preventing its onset in people with pre-diabetes [11,27]. Structured lifestyle changes and certain pharmacotherapies are beneficial in preventing or delaying the development of diabetes in people with pre-diabetes [8,11], but their impact on reducing mortality or the incidence of cardiovascular disease is unknown [8].

A strength of the present study is that the participants with pre-diabetes completed the SF-36 questionnaire before they knew the results of their oral glucose tolerance test, so the diagnosis of pre-diabetes did not affect the participants' perceived quality of life.

The present study also has some limitations, which include its cross-sectional design and the number of studied subjects. The authors grouped previously and newly diagnosed participants with diabetes into the same category and their scores were not compared. It has been recommended that a diabetes-specific measure for assessing health-related quality of life should be used in addition to the SF-36 scale, but in the present study we did not use a diabetes-specific measure.

In conclusion, there was no association between quality-of-life domains and glucose metabolism status in our Iranian study population. More longitudinal studies are necessary to investigate the natural history of pre-diabetes, diabetes and quality of life. As a result of increasing life expectancy and the association of Type 2 diabetes with age, a focus on preventive programmes is necessary.

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Competing interests

None declared.

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